Space Weather Technical Forecast

Issued on Thursday, 22 August 2024 at 13:13 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Further R1/R2 flares likely, slight chance of R3 flares. Slight chance of G1/Minor Storms for Days 1-2 (22-23 Aug).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Moderate, with two M-class flares recorded in the last 24 hours, the peak being an M5.1 flare from AR3796 at 21/2208UTC.

There are now eleven regions on the visible disc, including two unnumbered regions in the southeast. The largest and most complex regions on the disc are AR3790 and AR3796. AR3790 now centre disc in the south has shown some consolidation and growth in its lead and trailer portions, with a small delta feature now visible to the north of the leading spot. AR3796 in the southeast has shown some growth in its leading portion and maintains some magnetic complexity. The other sunspot regions are comparatively smaller or less complex, and mostly either stable or in slight decay.

A filament lift-off south of AR3793 around 21/1700UTC produced significant darkening on SDO/AIA 211 imagery close to centre disc and may have produced a CME with an Earth directed component. Relevant coronagraph imagery is currently awaited in order to conduct a full analysis of this event although a significant Earth-directed component now looks unlikely.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by ACE at L1, showed a generally background regime. The solar wind speed varied between around 300-370km/s. The density was largely below average but increased towards average levels by the end of the period. The Interplanetary Magnetic Field, Bt, was weak to moderate, 6-9nT. The north-south component, Bz, varied weakly but was often southward directed, between +6/-6nT The phi angle was mostly positive (away from the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 remained at background levels.

High energy electron flux (greater than 2MeV) observed at GOES16 was at generally background levels. The 24-hour fluence was below the Active threshold, with 1.71e6 integrated pfu observed at 22/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Further M-class flares are likely during the period with a slight chance of X-flares.

Solar Wind /Geomagnetic Activity: The geomagnetic forecast is of lower-than-average confidence in detail for this period. HSS influence from coronal holes CH60/+ and CH61/+ is likely into later Day 1 (22 Aug), perhaps combining with a CME from 17 August, although this is

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low confidence. Solar winds likely increasing towards slightly elevated or elevated levels around 450-500km/s, with this HHS influence slowly declining through Day 2 into Day 3 (23-24 Aug). Geomagnetic conditions are expected to be largely quiet to unsettled (Kp2-3) but with active (Kp4) intervals likely at times and a slight chance of isolated G1/minor storm intervals should we see any significant coronal hole influence.

Energetic Particles / Solar Radiation: High energy proton flux is likely to remain at background levels, with a chance of exceeding the S1/Minor solar radiation storm level should any notable flares occur.

High energy electron flux is expected to remain at background levels. The associated 24-hour fluence is expected to be below the Active level but with a rising trend expected later in the period.

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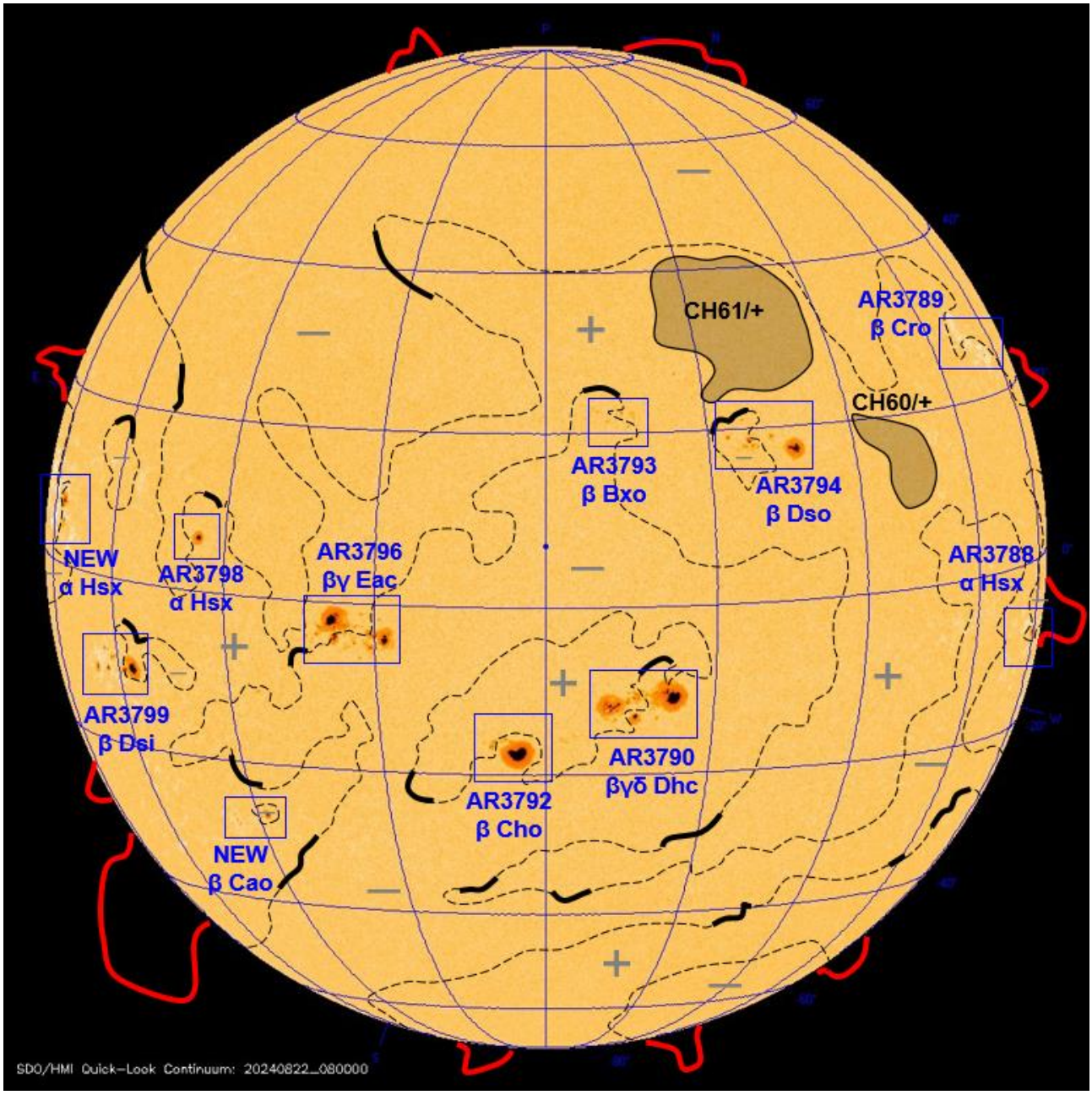
Figure 1. Solar Analysis Valid 22/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

The geomagnetic forecast is of lower-than-average confidence in detail for this period. The reasons for uncertainty are: the large number of minor transients observed in coronagraph imagery; the marginal nature of a potentially inbound CME; and finally due to the altering shape of the two coronal holes, CH60/+ and CH61/+. There was some potentially High Speed Stream (HSS) related influence on the last rotation, although with an uncertain source at that time as no coronal holes were visible on the disc.

A CME emerged from a broad upper coronal reconfiguration, occurring around 17/1030UTC across a large span of 40N. This resultant CME is most likely to stay above the ecliptic plane, but has an increasingly small chance of giving glancing impacts Day 1(22 Aug) - particularly should it interact with the fast wind from CH60/+.

A filament lift-off south of AR3793 around 21/1700UTC produced significant darkening on SDO/AIA 211 imagery close to centre disc and may have produced a CME with an Earth-directed component. Relevant coronagraph imagery is currently awaited in order to conduct a full analysis of this event although a significant Earth-directed component now looks unlikely.

HSS influence from coronal holes CH60/+ and CH61/+ is likely into later Day 1 (22 Aug), perhaps combining with the CME from 17 August, although this is low confidence. Solar winds likely increasing towards slightly elevated or elevated levels around 450-500km/s with this HHS influence slowly declining through Day 2 into Day 3 (23-24 Aug).

Geomagnetic conditions are expected to be largely quiet to unsettled (Kp2-3) but with active (Kp4) intervals likely at times and a slight chance of isolated G1/minor storm intervals should we see any significant coronal hole influence.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	20	10	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
17/2001	Partial	High coronal	40N across centre disc	368 km/s	Crosses 1AU 21/1200 UTC	Possible, low confidence, may interact with CH60/+

Figure 2: Latest MOSWOC ENLIL model output.

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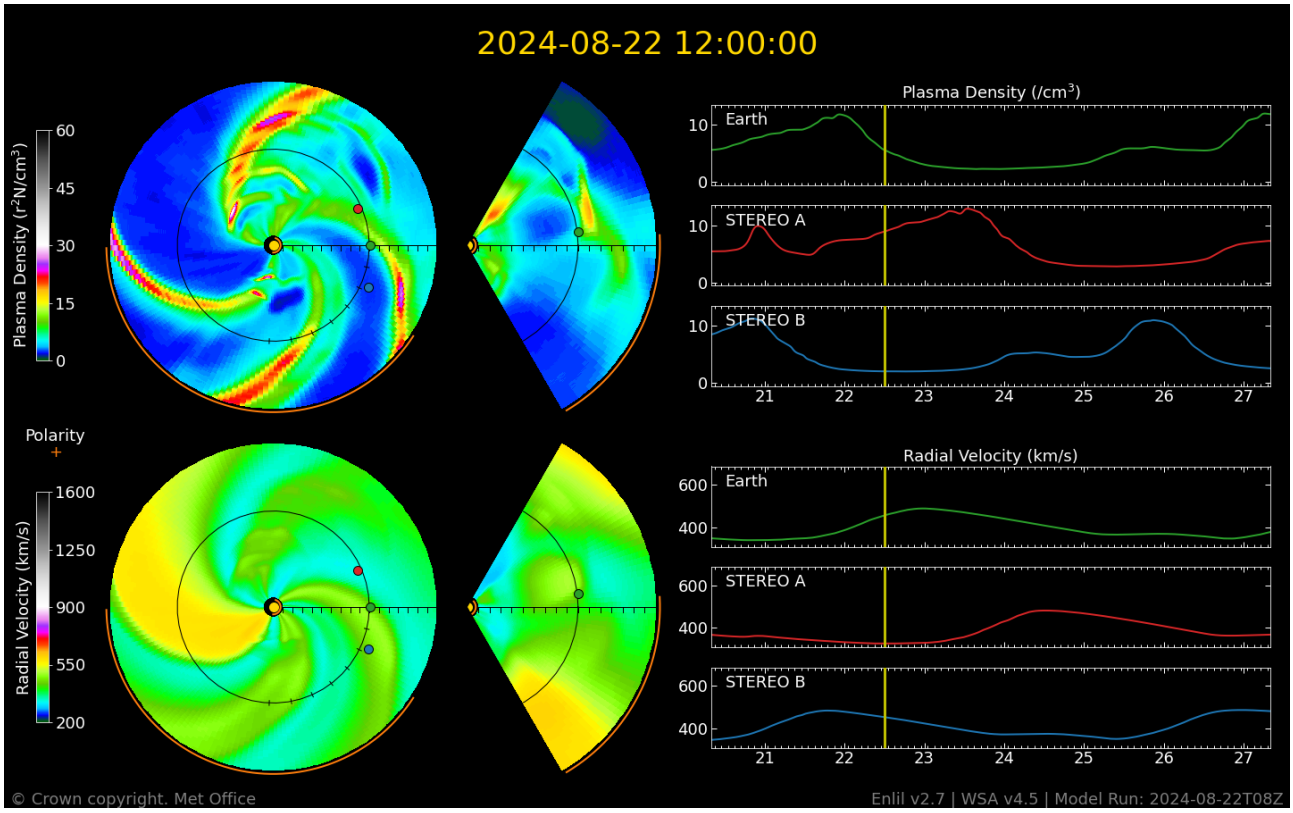
Space Weather Technical Forecast



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Radio Blackouts - X-Ray Flares:
Further M-class flares are likely given the number and complexity of active regions on the disk, with a slight chance of isolated X-class flares. The bulk of the flare risk originating now from AR3790 and AR3796, and the risk of flares dropping just slightly into the period pending further developments as AR3784 rotates further away around the western limb. Currently no significant new regions signaled to arrive over the eastern horizon from far-side soundings or persistence.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	70	65	60	60
Very Active	R3 to R5 X Class	No	10	10	10	10

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Solar Radiation Storms - (High Energy Protons):
High energy proton flux at GOES18 is likely to persist at background levels, but with a chance of rising in response to any notable flares.

AR3784 just over the western limb is still the main region of interest for proton flux risk at present, but this risk slowly reducing once it gets well past the limb later in this period. However, AR3790, and increasingly AR3796, are rotating onto the western disc, with a gradually increasing risk of proton events from these feature which will largely balance the reducing AR3784, resulting in a generally steady risk.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	20	20	20	20
Very Active	**≥ S3 ***	No	5	5	5	5

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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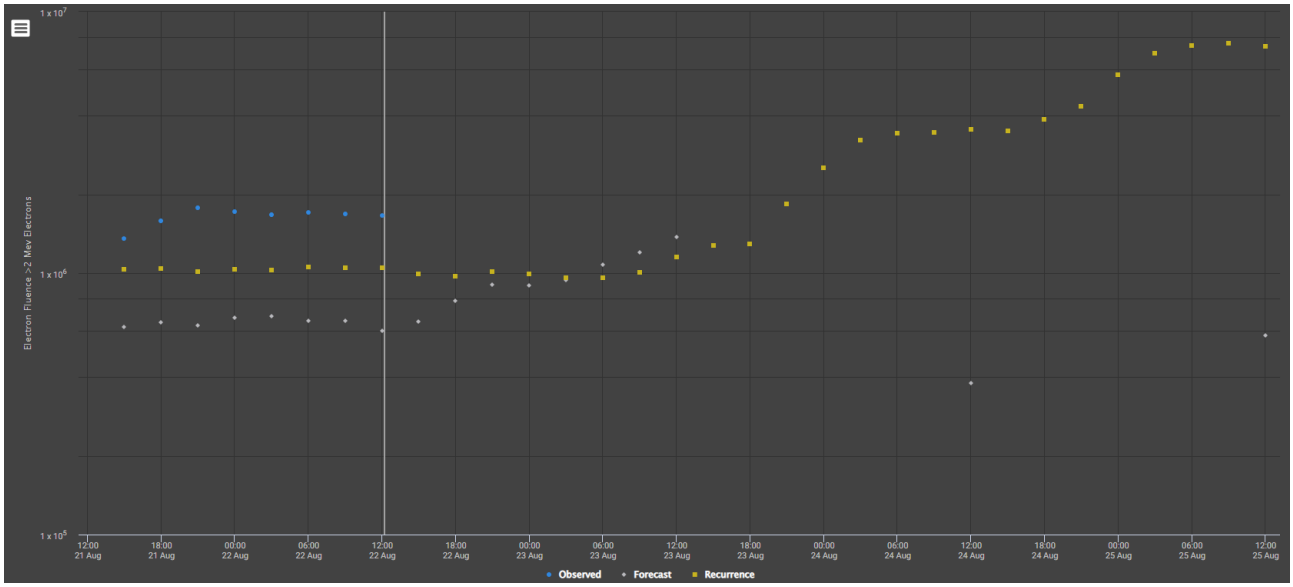
High Energy Electrons Event (≥ 2MeV):

The high energy electron forecast is of low confidence. Current background electron flux levels are now considered likely to remain that way after recent CME effects, as the solar winds have now returned to background levels. Upcoming HSS influence is expected to keep flux levels at background to start, although an increase to moderate or high diurnal levels is possible later in the period.

Fluence is expected to remain below the Active (1e8 integrated pfu) through the rest of this period but with a rising trend expected. MOSWOC REFM looks to be providing reasonable guidance.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	5	10
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 3: Latest MOSWOC REFM model output.



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